

CLAIMS

We claim:

1. In an audio encoder, a computer-implemented method of audio encoding according to a control strategy, the method comprising:
 - 5 encoding a sequence of audio data using a trellis to produce an output bitstream of the audio data at constant or relatively constant bitrate, wherein the trellis include plural transitions, and wherein each of the plural transitions corresponds to an encoding of a chunk of plural samples of the audio data at a quality level; and
 - outputting the bitstream.
- 10 2. The method of claim 1 wherein the encoding includes pruning the trellis according to a cost function.
3. The method of claim 2 wherein the cost function considers noise to excitation
- 15 ratio.
4. The method of claim 2 wherein the cost function considers both quality and smoothness of quality changes.
- 20 5. The method of claim 1 further comprising:
 - storing encoded data for each of plural chunks encoded at each of plural quality levels;

determining a trace through the sequence, wherein the trace includes a determination of a selected quality level for each of the plural chunks; and stitching together parts of the stored encoded data for the sequence along the trace to produce the output bitstream.

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6. The method of claim 1 wherein the encoding is two-pass encoding.

7. The method of claim 1 wherein the encoding is delayed-decision encoding.

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8. The method of claim 7 wherein the encoding includes simplifying the trellis according to one or more criteria, if necessary, as the trellis exits a latency window, wherein the one or more criteria are based upon a candidate node exiting the latency window and one or more current nodes that descend from the candidate node.

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9. The method of claim 1 wherein the trellis includes plural nodes based upon quantization of buffer fullness levels.

10. The method of claim 9 wherein the buffer fullness levels are for a virtual decoder buffer.

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11. The method of claim 9 wherein the buffer fullness levels are for an encoder buffer.

12. The method of claim 9 wherein the quantization is adaptive depending on range of the buffer fullness levels.

5 13. The method of claim 1 wherein the outputting is to a persistent storage medium.

14. The method of claim 1 wherein the outputting is to a network connection.

10 15. The method of claim 1 wherein the outputting begins before the encoding ends.

16. A computer-readable medium storing computer-executable instructions for causing a computer system programmed thereby to perform the method of claim 1.

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17. In a media encoder, a computer-implemented method of media encoding according to a control strategy, the method comprising:

in a first pass, encoding a sequence of media data using a trellis to determine a trace through the sequence of media data, wherein the media data includes plural portions, and wherein the trace includes a determination of a quality level for each of the plural portions of the media data;

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in a second pass, encoding the sequence of media data along the trace to produce an output bitstream of the media data at constant or relatively constant bitrate; and outputting the bitstream.

5 18. A computer-readable medium storing computer-executable instructions for causing a computer system programmed thereby to perform the method of claim 17.

19. The method of claim 17 wherein each of the portions is a chunk of plural samples.

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20. The method of claim 17 wherein the media data are audio data.

21. In a media encoder, a computer-implemented method of media encoding according to a control strategy, the method comprising:

15 encoding a sequence of media data using a trellis to produce an output bitstream of the media data at constant or relatively constant bitrate, wherein the encoding includes pruning the trellis according to a cost function that considers quality according to noise to excitation ratio; and

outputting the bitstream.

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22. A computer-readable medium storing computer-executable instructions for causing a computer system programmed thereby to perform the method of claim 21.

23. The method of claim 21 wherein the media data are audio data.

24. In a media encoder, a computer-implemented method of media encoding
5 according to a control strategy, the method comprising:

encoding a sequence of media data using a trellis to produce an output bitstream
of the media data at constant or relatively constant bitrate, wherein the encoding
includes pruning the trellis according to a cost function that considers both quality and
smoothness in quality changes; and
10 outputting the bitstream.

25. A computer-readable medium storing computer-executable instructions for
causing a computer system programmed thereby to perform the method of claim 24.

15 26. The method of claim 24 wherein the media data are audio data.

27. In a media encoder, a computer-implemented method of media encoding
according to a control strategy, the method comprising:
encoding a sequence of media data, including encoding each of plural portions
20 of the sequence at each of multiple different quality levels;
storing encoded data for the plural portions encoded at each of the multiple
different quality levels;

determining a trace through the sequence of media data, wherein the trace includes a determination of a selected quality level for each of the plural portions;

stitching together parts of the stored encoded data for the sequence along the trace to produce an output bitstream of the media data at constant or relatively constant

5 bitrate; and

outputting the bitstream.

28. A computer-readable medium storing computer-executable instructions for causing a computer system programmed thereby to perform the method of claim 27.

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29. The method of claim 27 wherein the media data are audio data.

30. The method of claim 27 wherein the plural portions are for the entire sequence.

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31. In a media encoder, a computer-implemented method of media encoding according to a control strategy, the method comprising:

selecting between a two-pass encoding mode and a delayed-decision encoding mode;

20 if the two-pass encoding mode is selected,

in a first pass, encoding a sequence of media data to determine coding decisions for the sequence of media data; and

in a second pass, encoding the sequence of media data to produce an output bitstream of the media data at constant or relatively constant bitrate;

if the delayed-decision encoding mode is selected, encoding the sequence of media data, including enforcing simplification of a trace through the sequence of media data, if necessary, outside of a window of allowable latency; and
5 outputting the bitstream.

32. A computer-readable medium storing computer-executable instructions for causing a computer system programmed thereby to perform the method of claim 31.
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33. The method of claim 31 wherein the media data are audio data.

34. The method of claim 31 wherein the encoding in the first pass uses a trellis, and wherein the coding decisions indicate transitions in the trellis.
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35. The method of claim 31 wherein the encoding in the delayed-decision encoding mode uses a trellis.

36. In a media encoder, a computer-implemented method of media encoding
20 according to a delayed-decision control strategy, the method comprising:
encoding a sequence of media data using a trellis to produce an output bitstream of the media data at constant or relatively constant bitrate, wherein the encoding

includes simplifying the trellis according to one or more criteria, if necessary, as the trellis exits a latency window, wherein the one or more criteria are based upon a candidate node exiting the latency window and one or more current nodes that descend from the candidate node; and

5 outputting the bitstream.

37. A computer-readable medium storing computer-executable instructions for causing a computer system programmed thereby to perform the method of claim 36.

10 38. The method of claim 36 wherein the media data are audio data.

39. The method of claim 36 wherein the one or more criteria include average cost of the one or more current nodes.

15 40. The method of claim 36 wherein the one or more criteria include least cost of the one or more current nodes.

41. The method of claim 36 wherein the one or more criteria include count of the one or more current nodes.

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42. In a media encoder, a computer-implemented method of media encoding according to a control strategy, the method comprising:

encoding a sequence of media data using a trellis to produce an output bitstream of the media data at constant or relatively constant bitrate, wherein the trellis includes plural nodes based upon quantization of buffer fullness levels; and outputting the bitstream.

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43. A computer-readable medium storing computer-executable instructions for causing a computer system programmed thereby to perform the method of claim 42.

44. The method of claim 42 wherein the media data are audio data.

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45. The method of claim 42 wherein the buffer fullness levels are for a virtual decoder buffer.

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46. The method of claim 42 wherein the buffer fullness levels are for an encoder buffer.

47. The method of claim 42 wherein the quantization of the buffer fullness levels is adaptive.

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48. The method of claim 47 wherein the quantization changes depending on range of the buffer fullness levels.

49. In a media encoder, a computer-implemented method of media encoding according to a control strategy, the method comprising:

performing either two-pass or delayed-decision encoding of a sequence of media data;

5 checking whether the encoding has succeeded and, if the encoding has not succeeded, performing one-pass encoding of at least part of the sequence; and

outputting a bitstream of the encoded media data at constant or relatively constant bitrate.

10 50. A computer-readable medium storing computer-executable instructions for causing a computer system programmed thereby to perform the method of claim 49.